

WHAT IS CLAIMED IS:

1. A semiconductor light-receiving module  
comprising:

a semiconductor light-receiving element; and  
5 an incident light direction device,

wherein the semiconductor light-receiving element  
comprises:

a substrate;

at least a light absorbing layer and an upper  
10 cladding layer formed sequentially on the substrate;

a light incident facet formed on at least one  
facet of the substrate and the light absorbing layer;  
and

electrodes which output an electric signal  
15 generated by absorption of the light entering from the  
light incident facet in the light absorbing layer, and

wherein the incident light direction device  
directs to irradiate the light obliquely to the light  
incident facet of the semiconductor light-receiving  
20 element, and to cause at least one part of the light to  
irradiate the light absorbing layer at the light  
incident facet.

2. The semiconductor light-receiving module  
according to claim 1, wherein the incident light  
25 direction device directs to irradiate the light  
obliquely to the light incident facet, and to cause at  
least part of the light to irradiate the light

absorbing layer at the light incident facet, such that an effective index of the light becomes higher than a refractive index of the upper cladding layer of the semiconductor light-receiving element and

5            wherein the semiconductor light-receiving element propagates, of the light entering the light absorbing layer, at least one of a component propagating parallel to the interface with the upper cladding layer positioned above the light absorbing layer, and a  
10           component propagating in an oblique direction in the light absorbing layer by reflecting at the interface above the light absorbing layer.

3. The semiconductor light-receiving module according to claim 1, wherein the upper cladding layer  
15           of the semiconductor light-receiving element is made of a p-type or n-type semiconductor material.

4. The semiconductor light-receiving module according to claim 1, wherein an angle formed between the light incident facet and the bottom face of the  
20           light absorbing layer of the semiconductor light-receiving element is set at 90 degrees.

5. The semiconductor light-receiving module according to claim 1, wherein an angle formed between the light incident facet and the bottom face of  
25           the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and at an angle determined by a crystal azimuth of

a material for composing the light incident facet.

6. The semiconductor light-receiving module according to claim 1, wherein an angle formed between the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and at an angle larger than the angle determined by a crystal azimuth of a material for composing the light incident facet.

7. A semiconductor light-receiving module comprising:

a semiconductor light-receiving element; and  
an incident light direction device,  
wherein the semiconductor light-receiving element comprises:

a substrate;

a lower semiconductor layer formed on the substrate, and having a function as an optical waveguide;

a light absorbing layer formed on the lower semiconductor layer, and having a refractive index higher than that of the lower semiconductor layer;

an upper cladding layer formed on the light absorbing layer, and having a refractive index lower than that of the lower semiconductor layer;

a light incident facet formed on so as to include at least one facet of the substrate, the lower

semiconductor layer and the light absorbing layer; and  
electrodes which output current generated by  
absorption of the light entering from the light  
incident facet in the light absorbing layer, by way of  
5 the upper cladding layer and the lower semiconductor  
layer, and

wherein the incident light direction device  
directs to irradiate the light at a predetermined angle  
from the light incident facet of the semiconductor  
10 light-receiving element, and thereby a part of the  
light entering the light absorbing layer of the  
semiconductor light-receiving element can propagate in  
a parallel direction to the bottom face of the upper  
cladding layer in at least one of the light absorbing  
15 layer and the lower semiconductor layer, while another  
part of the light entering the light absorbing layer is  
reflected at the bottom face of the upper cladding  
layer and can propagate in an oblique direction in the  
light absorbing layer and the lower semiconductor  
20 layer.

8. The semiconductor light-receiving module  
according to claim 7, wherein an angle formed between  
the light incident facet and the bottom face of the  
light absorbing layer of the semiconductor  
25 light-receiving element is set at 90 degrees.

9. The semiconductor light-receiving module  
according to claim 7, wherein an angle formed between

the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and at an angle determined by a crystal azimuth of a material for composing the light incident facet.

10. The semiconductor light-receiving module according to claim 7, wherein an angle formed between the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and at an angle larger than the angle determined by a crystal azimuth of a material for composing the light incident facet.

11. The semiconductor light-receiving module according to claim 7, wherein the lower semiconductor layer of the semiconductor light-receiving element is made of a semiconductor material of quaternary composition.

12. The semiconductor light-receiving module according to claim 7, wherein the lower semiconductor layer is composed of a combination of a high-refractive-index layer and a low-refractive-index layer such that an effective index of the lower semiconductor layer becomes higher than a refractive index of the upper cladding layer, for the light entering the light incident facet of the semiconductor light-receiving element.

13. The semiconductor light-receiving module according to claim 7, wherein the lower semiconductor layer of the semiconductor light-receiving element is made of an n-type semiconductor material, and the upper  
5 cladding layer is made of a p-type semiconductor material.

14. The semiconductor light-receiving module according to claim 7, wherein the lower semiconductor layer of the semiconductor light-receiving element is  
10 made of a p-type semiconductor material, and the upper cladding layer is made of an n-type semiconductor material.

15. The semiconductor light-receiving module according to claim 7, wherein the light entering the  
15 light incident facet is irradiated the light absorbing layer through at least the lower semiconductor layer, by adjusting at least one of the incident position and incident angle of the light with respect to the light incident facet of the semiconductor light-receiving  
20 element.

16. A semiconductor light-receiving module comprising:

a semiconductor light-receiving element; and  
an incident light direction device,  
25 wherein the semiconductor light-receiving element comprises:  
a substrate;

a lower semiconductor layer formed on the substrate, and having a function as an optical waveguide;

5 a light absorbing layer formed on the lower semiconductor layer, and having a refractive index higher than that of the lower semiconductor layer;

an upper cladding layer formed on the light absorbing layer, and having a refractive index lower than that of the lower semiconductor layer;

10 a light incident facet formed on so as to include at least one facet of the substrate, the lower semiconductor layer and the light absorbing layer; and

electrodes which output current generated by absorption of the light entering from the light  
15 incident facet in the light absorbing layer, by way of the upper cladding layer and the lower semiconductor layer, and

wherein the incident light direction device directs to irradiate the light at a predetermined angle  
20 from the light incident facet of the semiconductor light-receiving element, and thereby the light entering the light absorbing layer of the semiconductor light-receiving element is allowed to enter the bottom face of the upper cladding layer at a critical angle  
25 and to be totally reflected at the bottom face of the upper cladding layer, is also allowed to propagate in at least one of the light absorbing layer and the lower

semiconductor layer in a parallel direction to the bottom face of the upper cladding layer.

17. The semiconductor light-receiving module according to claim 16, wherein the angle formed between  
5 the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at 90 degrees.

18. The semiconductor light-receiving module according to claim 16, wherein an angle formed between  
10 the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and at an angle determined by a crystal azimuth of a material for composing the light incident facet.

15 19. The semiconductor light-receiving module according to claim 16, wherein an angle formed between the light incident facet and the bottom face of the light absorbing layer of the semiconductor light-receiving element is set at less than 90 degrees, and  
20 at an angle larger than the angle determined by a crystal azimuth of a material for composing the light incident facet.

20. The semiconductor light-receiving module according to claim 16, wherein the lower semiconductor  
25 layer of the semiconductor light-receiving element is made of a semiconductor material of quaternary composition.



21. The semiconductor light-receiving module according to claim 16, wherein the lower semiconductor layer is composed of a combination of a high-refractive-index layer and a low-refractive-index layer such that an effective index of the lower semiconductor layer becomes higher than a refractive index of the upper cladding layer, for the light entering the light incident facet of the semiconductor light-receiving element.

22. The semiconductor light-receiving module according to claim 16, wherein the lower semiconductor layer of the semiconductor light-receiving element is made of an n-type semiconductor material, and the upper cladding layer is made of a p-type semiconductor material.

23. The semiconductor light-receiving module according to claim 16, wherein the lower semiconductor layer of the semiconductor light-receiving element is made of a p-type semiconductor material, and the upper cladding layer is made of an n-type semiconductor material.

24. The semiconductor light-receiving module according to claim 16, wherein the light entering the light incident facet is irradiated the light absorbing layer through at least the lower semiconductor layer, by adjusting at least one of the incident position and incident angle of the light with respect to the light

incident facet of the semiconductor light-receiving element.

25. A semiconductor light-receiving module comprising:

5           a semiconductor light-receiving element having at least a light incident facet, a light absorbing layer and an upper cladding layer formed on the light absorbing layer; and

          an incident light direction device which directs  
10       light to the light incident facet of the semiconductor light-receiving element,

          wherein the incident light direction device directs to irradiate the light obliquely to the light incident facet of the semiconductor light-receiving  
15       element, such that an effective index of the light irradiated the light incident facet becomes higher than a refractive index of the upper cladding layer.